



STRAZA INDUSTRIES MODEL 1201

MICROFILM PRINTER

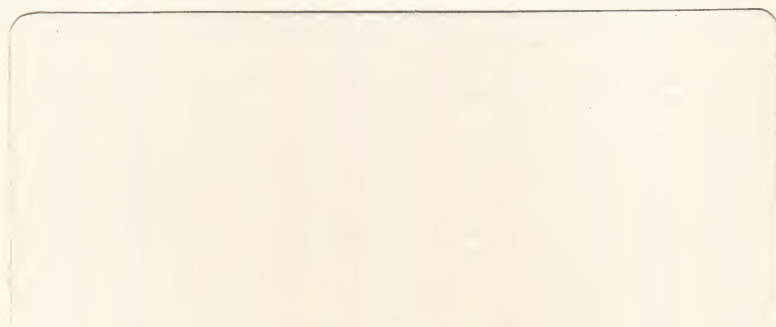
PRODUCT SPECIFICATION

No. 8-70000045

STRAZA INDUSTRIES

164 EAST SUNSET ROAD

LAS VEGAS, NEVADA



STRAZA MODEL 1201
MICROFILM PRINTER

The Model 1201 Microfilm Printer is an off-line computer output device that will accept six bit tape characters plus a parity bit from most of the magnetic tape transports that are in use today.

Its input logic performs lateral and transverse parity check and controls start and stop of the tape automatically. The design of the input logic is flexible so that it can be adapted to the special needs of the tape unit that it will be working with.

The logic circuits assemble six bit tape characters to 36 bit words, interpret commands, steer and sequence data to other circuits and generate control pulses for internal use in the microfilm printer.

In plotting mode a selected symbol or a dot may be positioned at any of the approximately 1.8 million possible locations on the 1320 by 1360 plotting matrix.

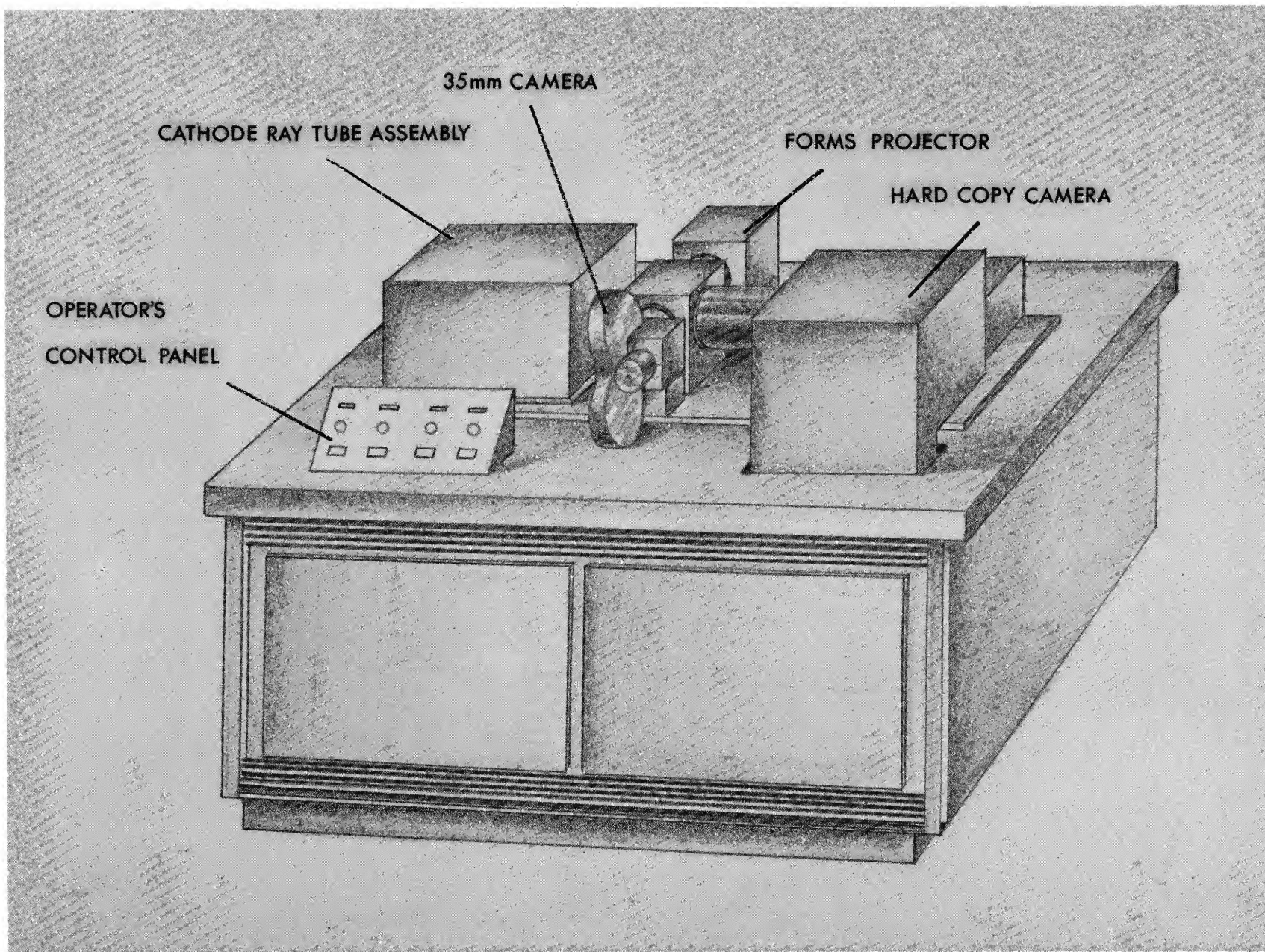
In the typewriter mode of operation, each six bit tape character selects any one of the 64 symbols that are available and positions them with 132 to each line and 68 lines to each page. This format may be varied by programming spaces, line reset, page advance, etc.

The 64 symbols are generated in the Model 11-64 symbol generator, which is one of the modules designed for the microfilm printer. Each symbol is formed from up to sixteen dots located at the intersections of a 15 x 16 grid line system. The symbol generator can generate up to 140,000 symbols per second but due to additional time needed for beam positioning, the operating speed of the printer is 62,500 symbols per second in either mode of operation.

The positioning information is converted from digital to analog form, added to the output from the symbol generator and impressed on the deflection yoke which is part of the display system. The alpha-numeric symbols appear as lighted areas on the cathode ray tube and can be photographed by means of a high quality, high speed 35mm camera. Frame advance is under tape control and can be completed in approximately 34 milliseconds.

Options:

1. The Straza Model 52 Line Generator causes straight lines to be drawn between any two points on the format.
2. The Straza Model 32 Hard Copy Camera will supply an alternate output on 8-1/2 x 11 inch photographic paper. It is available in two versions, one for on-line paper processing and the other for off-line processing.
3. The Straza Model 41 Forms Projector makes it possible to produce as an overlay, any standard business form. Exposure is controlled by the magnetic tape.



Straza Model 1201 Microfilm Printer

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No. 8-70000045

Straza Industries - Las Vegas Division
164 East Sunset Road
Las Vegas, Nevada 89109
Area Code 702 736-1962

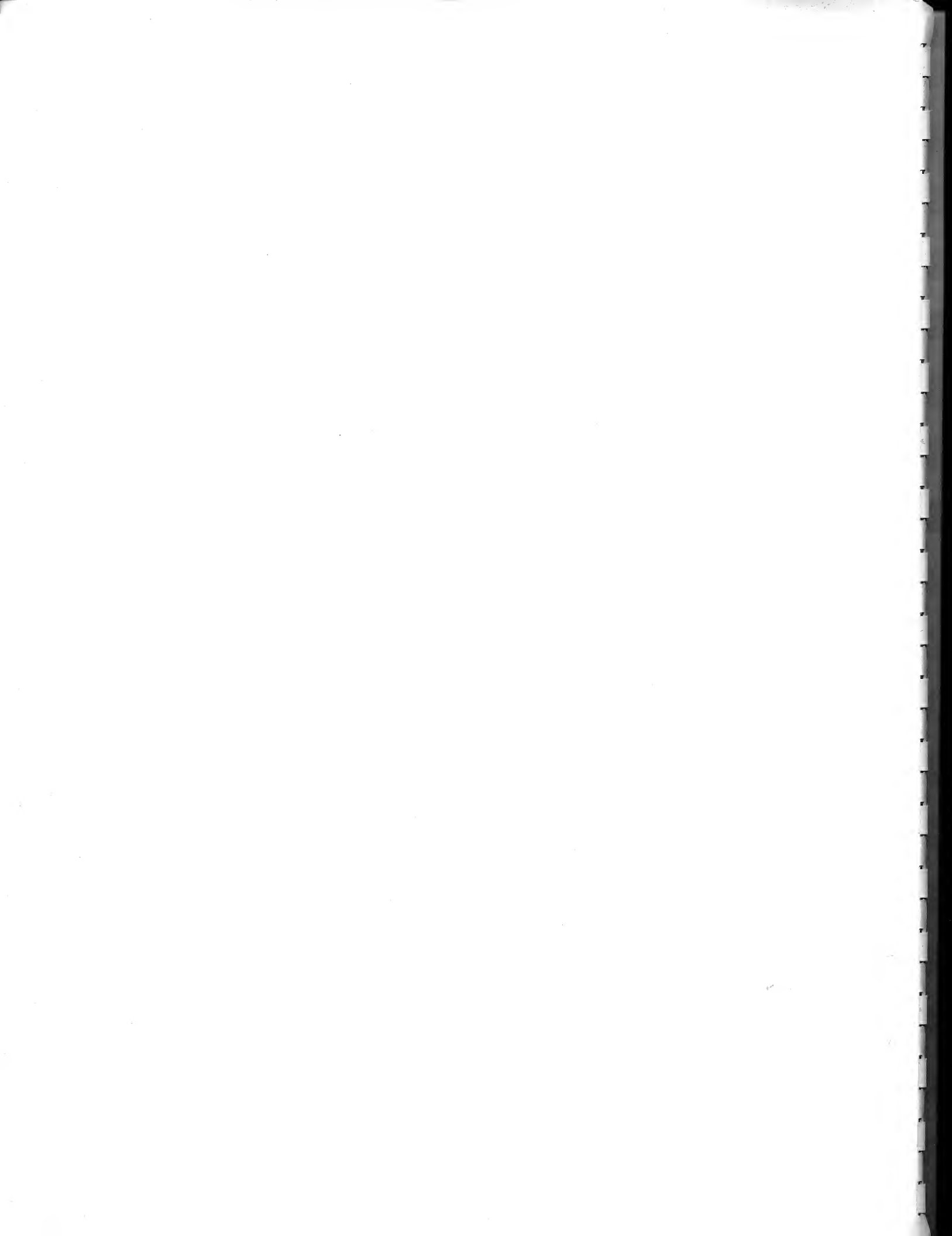


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1.0 SCOPE

This specification defines the Straza Industries Model 1201 Microfilm Printer, its functional characteristics and performance and its interface with other systems.

1.1 General

The Model 1201 Microfilm Printer is a computer output device operating at speeds in excess of 62,500 characters per second. It accepts signals from magnetic tape units, converts them to alphanumeric information which is displayed on a high resolution, high precision cathode ray tube and photographed on either 16 or 35 mm microfilm.

1.2 Packaging

Figure 1 shows the arrangement of the components of the basic 1201 printer. It also shows the location of two of the standard options. They are the Hard Copy Camera, Model 32, and the Form Projector, Model 41.

Logic bins, tube driving circuits and power supplies are located in standard width racks in the lower compartments, while all components of the optics system are mounted on a rigid cast aluminum plate supported on shock mounts.

1.3 Size and Weight

The over-all dimensions of the Model 1201 Microfilm Printer are 57" high, 47" long and 46" deep.

The weight will be less than 1,200 lbs.



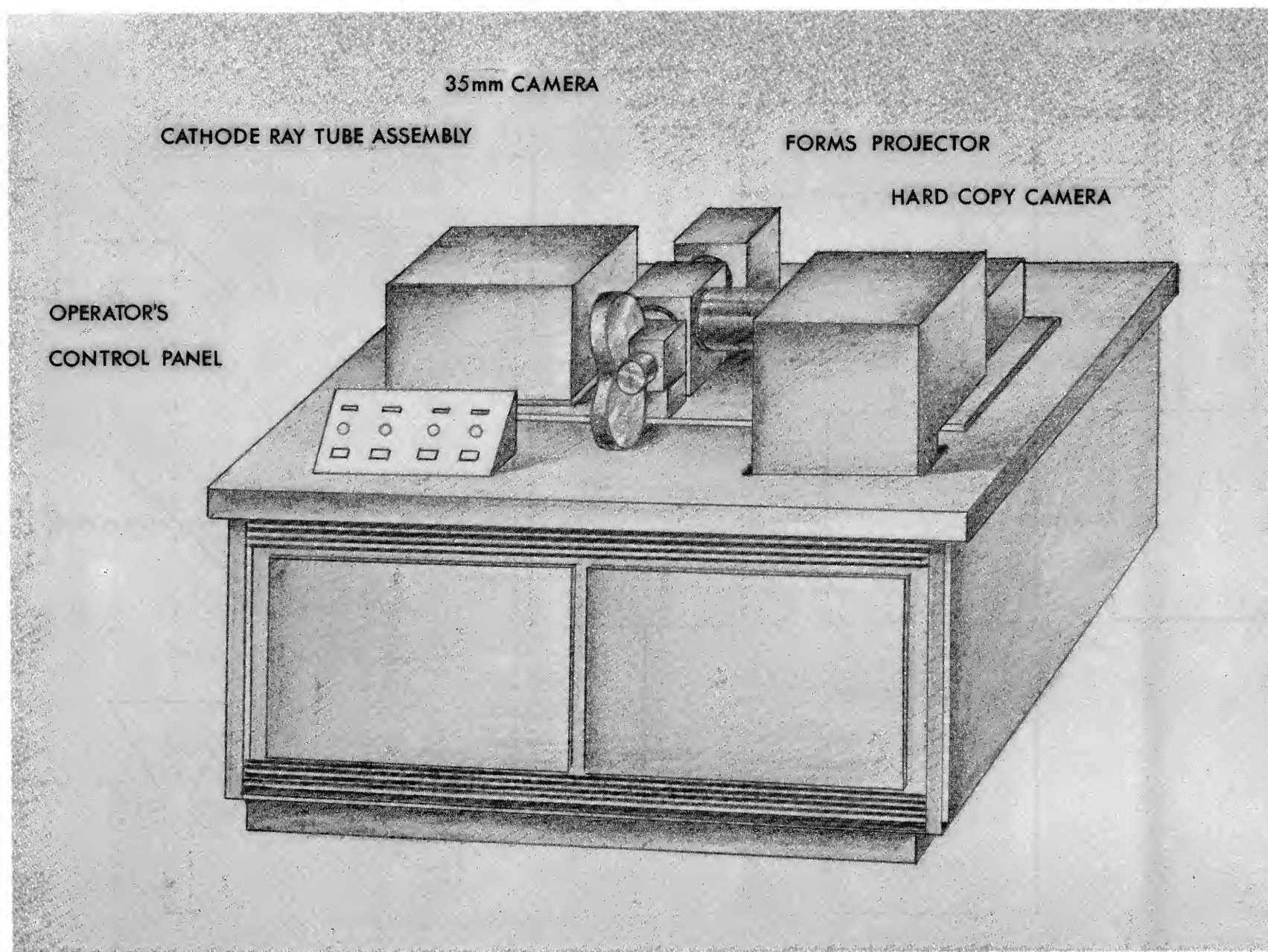


Figure 1



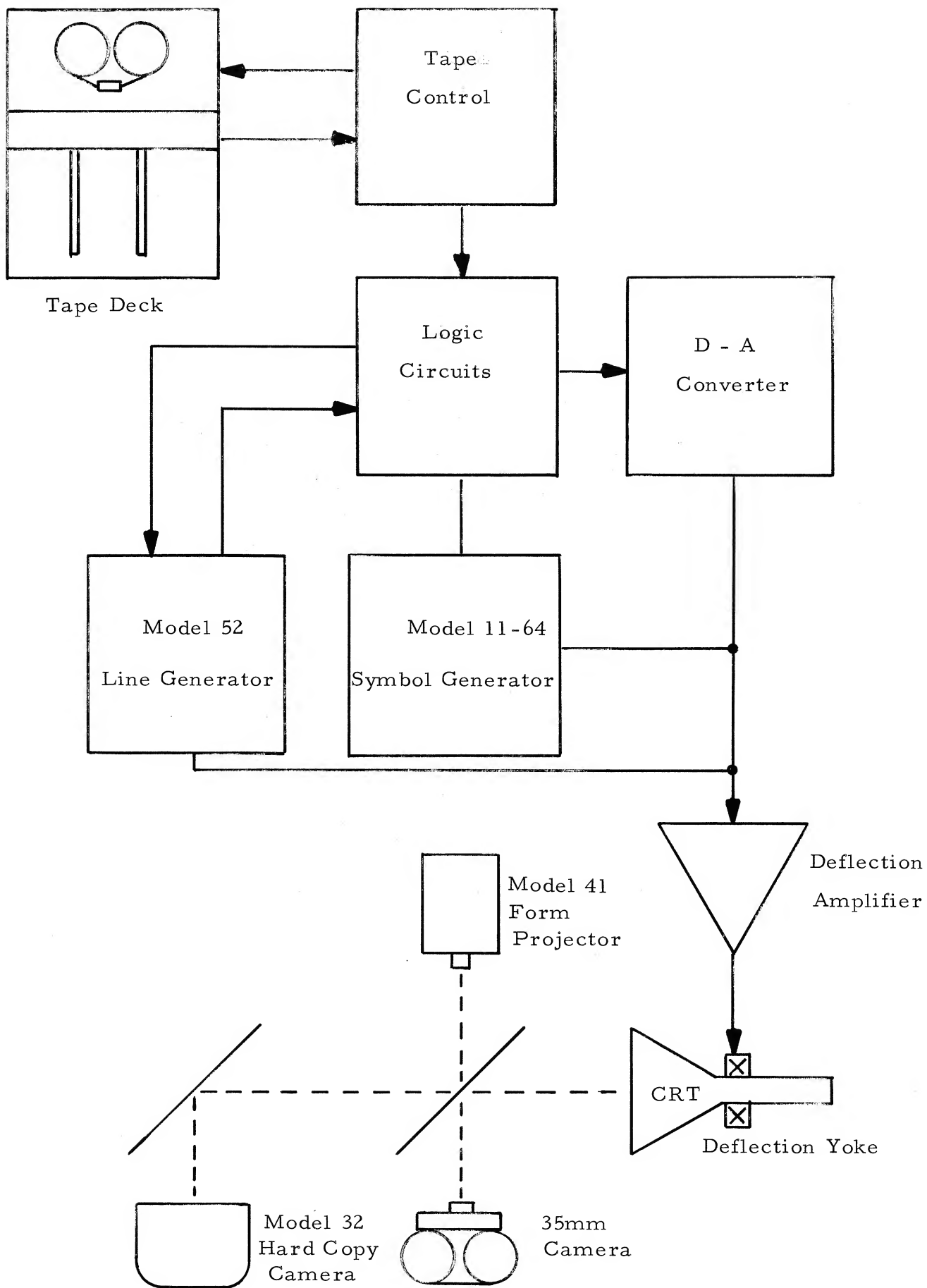


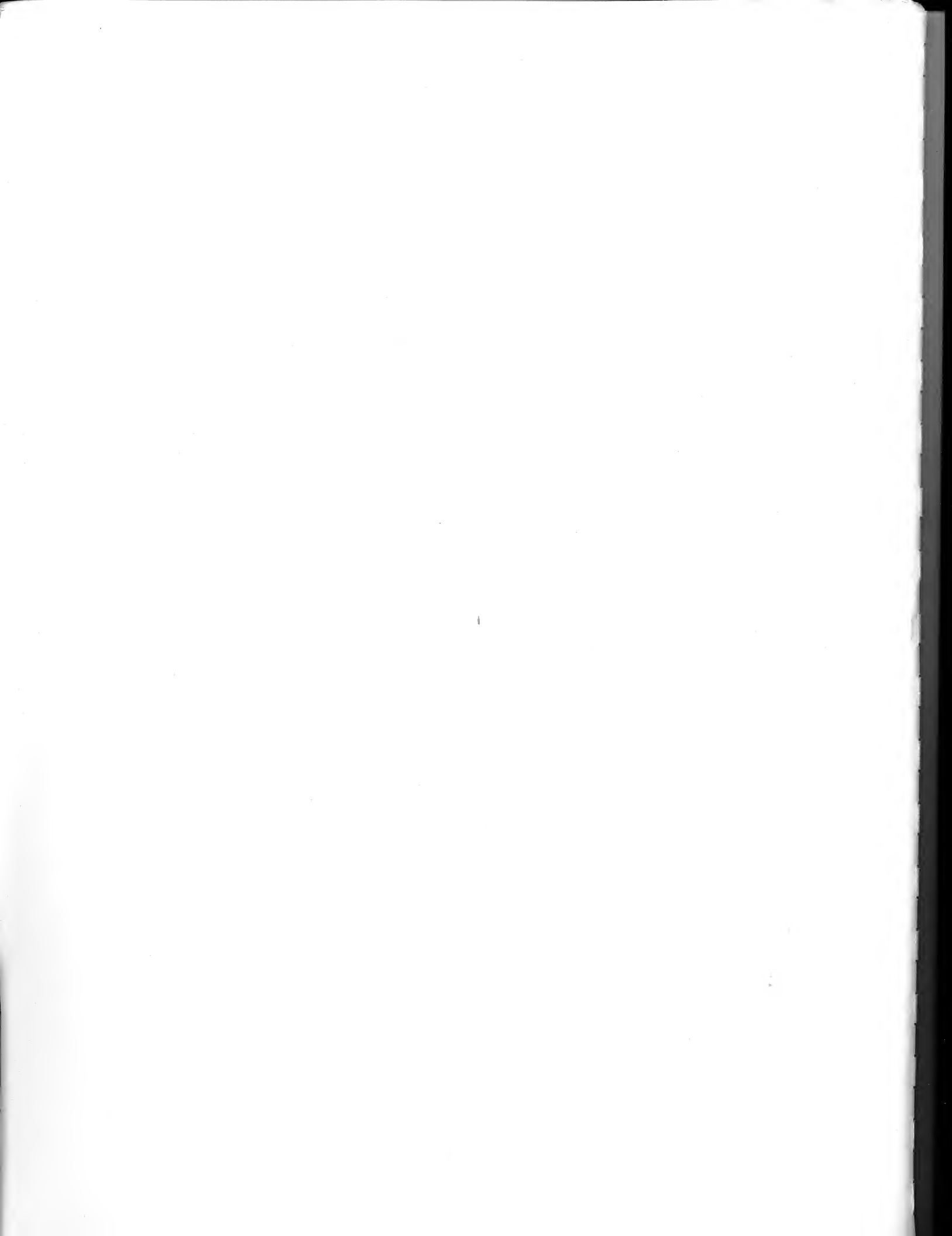
Figure 2





STRAZA

1201 PRINTER PLOTTER



1.4 Power Requirements

The Model 1201 requires three phase, WYE connected, four wire, 208/120 volt $\pm 5\%$ - 60 c/s power service. The neutral wire will not be grounded. A fifth wire is required for machine ground. The power consumption of the basic Model 1201 Microfilm Printer is less than 1500 watts.

1.5 Environment

The 1201 is designed to provide reliable, troublefree service when operated in an ambient temperature of $68^{\circ}\text{F} \pm 10^{\circ}\text{F}$, and relative humidity between 10% and 80%. The printer does not require ducted cooling air, compressed air or provision for chemical drainage.

1.6 Electronic Modules

The electronic circuits are packaged on printed circuit cards, housed in card bins. For ease of troubleshooting and maintenance, the card bins are hinged and mounted on chassis slides giving access to each circuit card connector and to the front of the card bin at the same time.

Semiconductors are used throughout the logic circuits, the deflection circuits and in all power supplies. The only vacuum tube used in the Model 1201 Microfilm Printer is the cathode ray tube.

The high frequency, high power transistors used in the deflection amplifiers are mounted on air-cooled heat sinks that also provide the electrical connections.

The card bins are built around the power supplies for the logic system, with the shortest possible lead length resulting in low noise level and minimized cross-talk.

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The high current supply for the deflection amplifiers has its controlling transistor mounted on the same heat sink as the yoke drivers in order to achieve a high degree of stability in the positioning circuits.

1.7 Signal Interface

The Model 1201 Microfilm Printer will operate from digital signals supplied by magnetic tape transports. Input data will be accepted by the printer character-at-a-time at speeds in excess of 62,500 tape characters per second.

2.0 DESCRIPTION

The Model 1201 Microfilm Printer consists of tape control circuits, logic circuits, a symbol generator, deflection and driving circuits, a cathode ray tube and a microfilm camera.

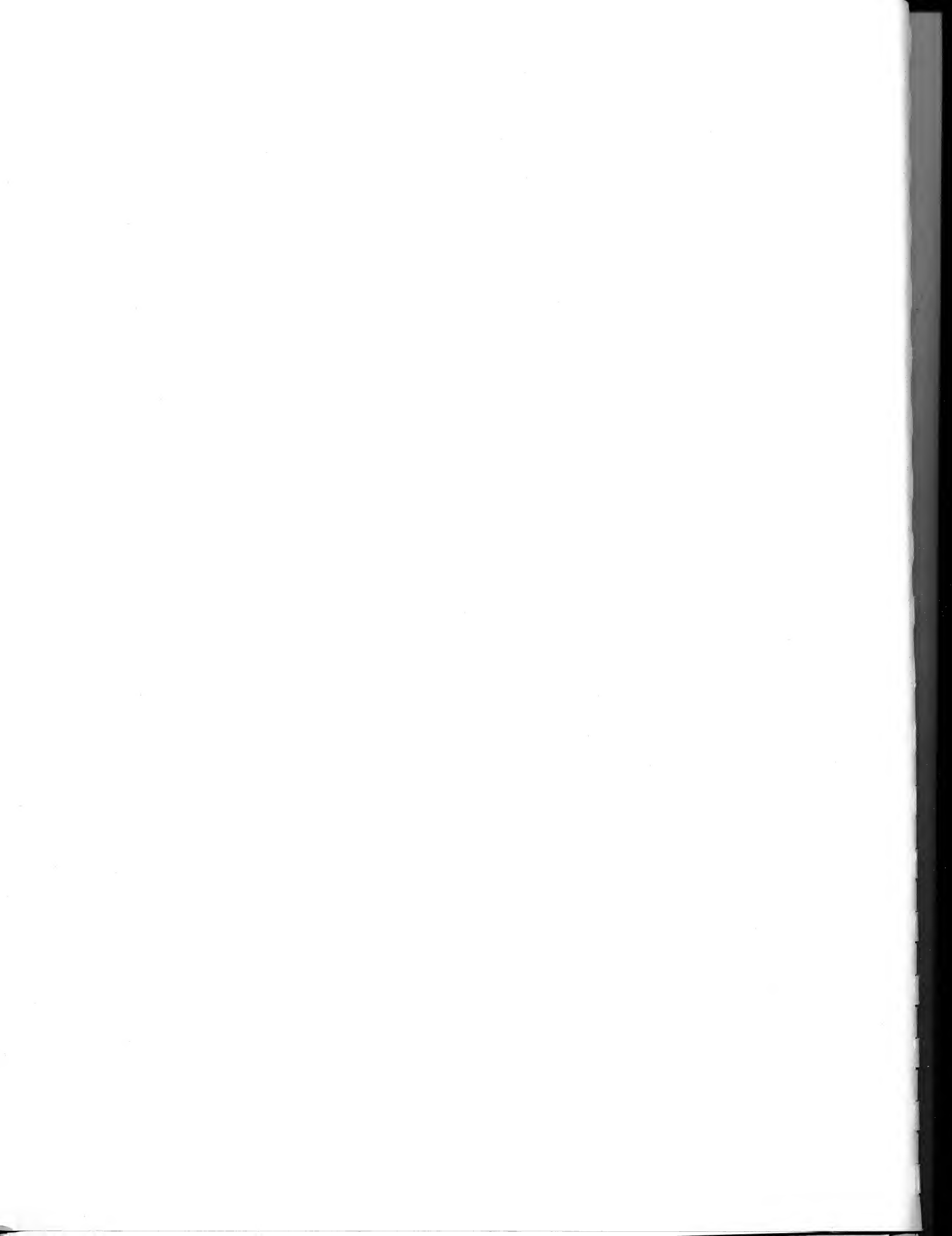
2.1 Tape Control Circuits and Logic Circuits

The control section of the 1201 accepts 7 bit tape characters, performs lateral and longitudinal parity checks, communicates with and exercises control over the tape unit.

The logic circuits interrogates the tape characters, identifies command codes, steers and sequences data to other modules and provides print format control and control of the microfilm camera.

For details of coding and data structure see Section 3.0 - Functional Characteristics.

In the plotting mode of operation characters are positioned in accordance with computer programmed X and Y position addresses of four decades each. Thus, a given character or dot may be positioned at any one of the



TAPE TRANSPORT	TAPE SPEED INCHES / SEC	RECORD DENSITY CHARACTERS / INCH	CHARACTER TIME MICROSECONDS	CHARACTER RATE THOUSAND PER SECOND
IBM 729 II	75	200	67	15.0
		556	24	41.667
IBM 729 IV	112.5	200	44	22.5
		556	16	62.5
IBM 729 V	75	200	67	15.0
		556	24	41.667
		800	16	60.0
IBM 729 VI	112.5	200	44	22.5
		556	16	62.5
		*800	11	90.0
IBM 7330	36	200	139	7.2
		556	50	20.0

*800 CPI cannot be read at 112.5 ips - use 729 V transport to operate the 1201 with 800 CPI tapes.

FIGURE 3



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approximately 1.8 million possible locations on a 1320 by 1360 plotting matrix. The logic and control section interprets the plotting operation code and directs symbol selection bits to the symbol generator and position bits to the X and Y digital-to-analog decoders in the CRT display. Timing and sequencing of these and other operations is controlled by this section also. In the printing mode, symbols are automatically positioned on the page by the logic and control section and it is only necessary for the tape to specify symbol selection. Symbols are printed 132 to the line and 68 lines to the page, starting at the upper left corner (or specified address - see Section 3.0) and progressing right to left and top to bottom in typewriter fashion. This format may be varied by programming spaces, line reset, film advance, and other commands. For further details, refer to Section 3.0.

2.2 Symbol Generator

The symbol generator (Straza Model 11-64) translates six-bit digital codes into alpha-numeric information which is fed to the CRT deflection circuits in the form of X, Y and Z levels.

Each symbol is formed by up to 16 dots on a 15 x 16 dot matrix. A total of 63 symbols plus one blank (space) are provided in the 11-64. If a larger symbol library is desired, the 11-64 symbol generator can be replaced by the 11-128, with up to 127 symbols, plus a blank.

The 11-64 and 11-128 symbol generators are described in Product Specification No. 8-60000000, which forms a part of this specification.



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2.3 Deflection Circuits

The deflection circuits consist of two D-A converters capable of changing 1320 horizontal and 1360 vertical increments into symmetrical analog voltages.

Two differential amplifiers with very high gain bandwidth, operate in a closed loop configuration and supply push pull currents to the two deflection yokes.

Three power supplies comprise a part of the deflection module. One is a ± 15 v high stability, dual power supply; another is a 28v high current supply for the yoke drivers; and the third power supply is a highly regulated 25kv supply.

2.4 Cathode Ray Tube

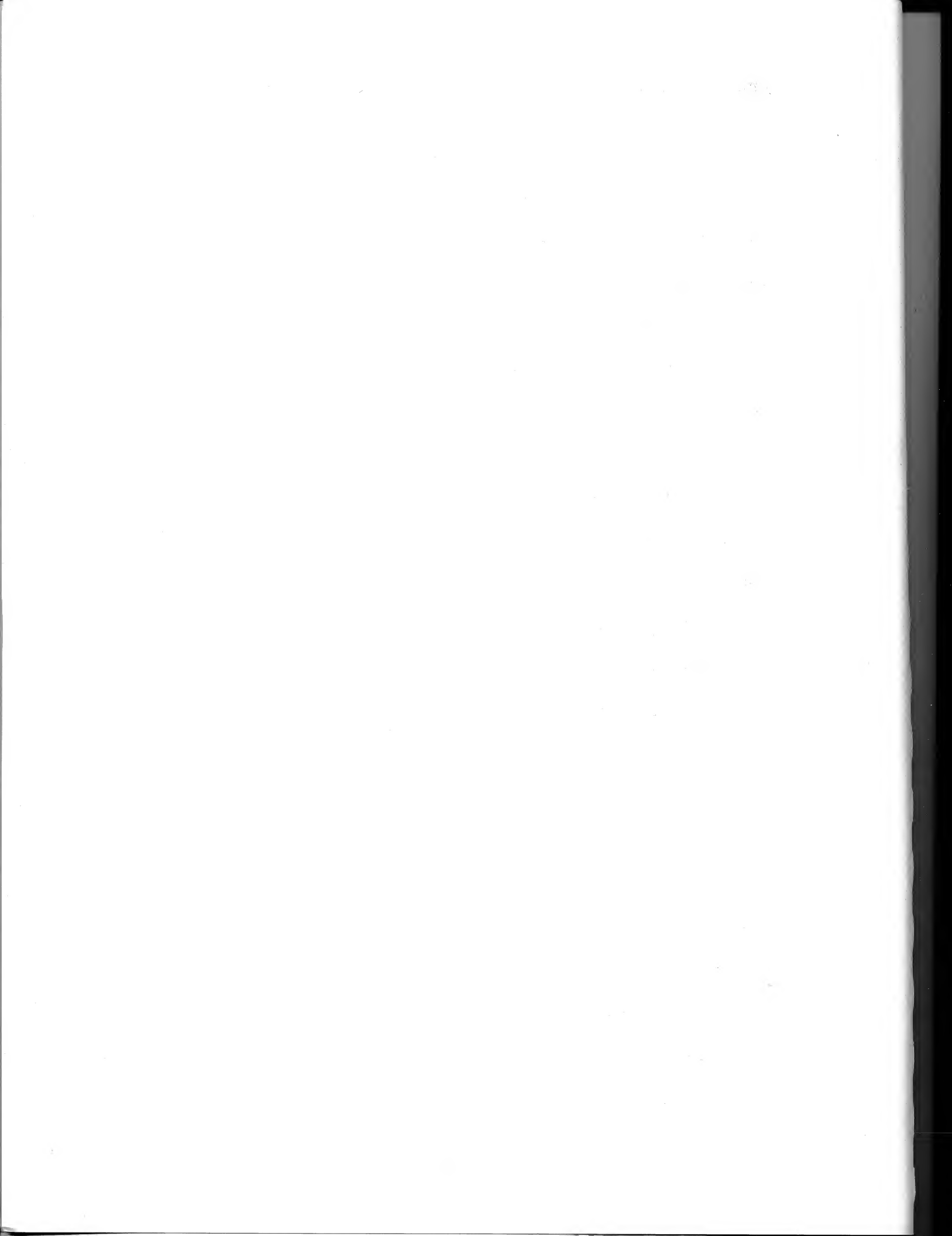
The cathode ray tube is a Model 6/22, made by Ferrante Electric, Inc. It has a 6" diameter flat faceplate and has a resolution of more than 2000 lines over a quality circle of 145mm.

It has a triode gun and is designed for magnetic deflection and magnetic focus.

The cathode ray tube is mounted with the deflection yoke and focus coil inside a magnetic shield that prevents any magnetic stray fields from affecting the positioning accuracy.

2.5 Microfilm Camera

A Model 207 camera, manufactured by Giannini Scientific Corporation is used in the 1201 microfilm printer. It is a very high quality camera



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designed for perforated 35mm film. Pull down time can be as fast as 34 milliseconds with a film registration of better than $\pm .001$ inches.

The camera is equipped with two of 400' magazines, that can be removed independently. A 1000' supply magazine can be delivered on special order. A number of interlocks are incorporated in order to prevent loss of recorded data. When the take up magazine is removed, the film is cut automatically at the point of entry into the magazine.

The image size on 35mm film is adjustable over a small range with a range center value of $.614 \times .777$ inches.

The microfilm printer can be supplied with a 16mm camera, instead of the 35mm camera. The 16mm camera has a similar specification as the Model 207 camera has.

Since the cathode ray tube has a phosphor similar to P11, the best image quality is obtained when a film that has peak sensitivity in the blue region is used. Satisfactory types are: Ansco-Hyscan, Ilford RX and Ilford BY.

3.0 FUNCTIONAL CHARACTERISTICS

3.1 General

The 1201 will produce high quality microfilm recordings of plotted graphs, tabular data listings and other data under tape control.

The basic 1201 is designed to operate off-line. It accepts as input a continuous string of 6-bit BCD characters, normally from a tape unit. The input "word length" is completely variable.

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3.2 Codes

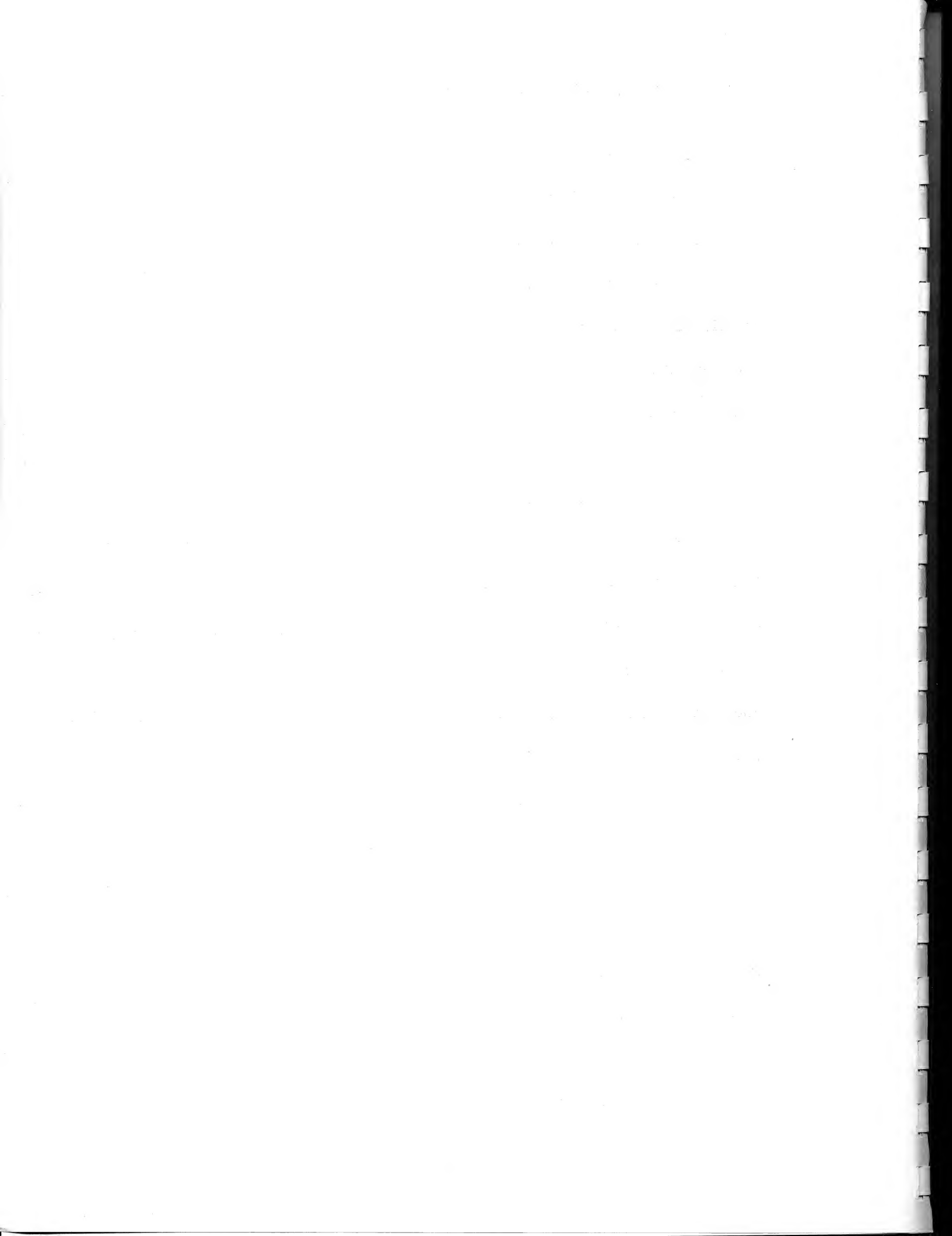
The code used for the 6-bit characters is standard IBM 729 BCD tape code with a parity bit. The 1201 will check for either odd, even, or no parity, depending on the position of a key actuated switch on the control panel. The operation codes were selected in such a way as to be most convenient for the internal codes of the IBM family of computers. However, where possible, the internal code of other widely used computers were given as much consideration as possible.

3.3 Operating Modes

At all times, the 1201 is operating in one of three modes. At random intervals, the incoming string of characters contains a signal character (XIT) which causes the 1201 to exit from the current mode. Immediately following the signal character is an operation character. Controlled by the operation character, the 1201 will prepare to enter one of the three modes in which it will remain until the signal character (XIT) is again encountered.

3.3.1 Instructions

Each operation character, in addition to defining a mode, forms the first character in a variable length command. A given command word may contain any or all of the applicable parameter characters. The parameter or modifier characters are used to specify the conditions applicable to the particular operation to be performed. The command word may be of variable length, and is not fixed by the printer which recognizes the first and last character codes (XIT).



3.3.2 No Operation

There exists a special "no operation" character (NOP). This character may be interspersed among the other characters in the input string in a completely unrestricted way. When it is encountered, the 1201 waits for the next character to come along, and interprets the latter as though it had immediately followed the last character before the intervening NOP's. This character is used for several purposes: (1) to provide for execution of commands by the 1201; (2) for the convenience of the programmer, e.g., in word oriented machines to avoid the inconvenience of packing words; (3) to fill in parameters for optional features not on a particular machine.

3.4 Plot Mode

In this mode, the command instructs the plot operation, specifying the size (except dots) and intensity to be used. It is followed by data representing the coordinates of the positions and the symbol(s) to be plotted.

3.4.1 Output Format

There are 1320 x 1360 addressable points on the plot format.

3.4.2 Input Data Format

The OP, or command word, is shown below. Word length is determined only by occurrence of the XIT and NTR characters, modifier characters being employed optionally.

XIT	OP	SYMBOL SIZE	HEAVY LIGHT	NTR	DATA FORMAT
-----	----	----------------	----------------	-----	-------------

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Data to be plotted will call out the coordinate(s) and symbol(s) as here shown:

X^0_{1000}	X^0_{100}	X^0_{10}	X^0_{10}	Y^0_{1000}	Y^0_{100}	Y^0_{10}	Y^0_1	S^0	X^1_{1000}
X^1_{100}	X^1_{10}	X^1_1	Y^1_{1000}	Y^1_{100}	Y^1_{10}	Y^1_1	S^1	X^2_{1000}	
X^2_{100}	X^2_{10}	X^2_1	Y^2_{1000}	Y^2_{100}	Y^2_{10}	Y^2_1	S^2	etc. to XIT	

3.5 Print Mode

In this mode, the commands are normally followed by a series of alphanumeric symbols which are printed across a line in the fashion of a typewriter. In this mode, only, there are special control characters which cannot be printed but which permit such functions as changing the size of the symbols and returning to the beginning of the next line without exiting from the printing mode.

3.5.1 Output Format

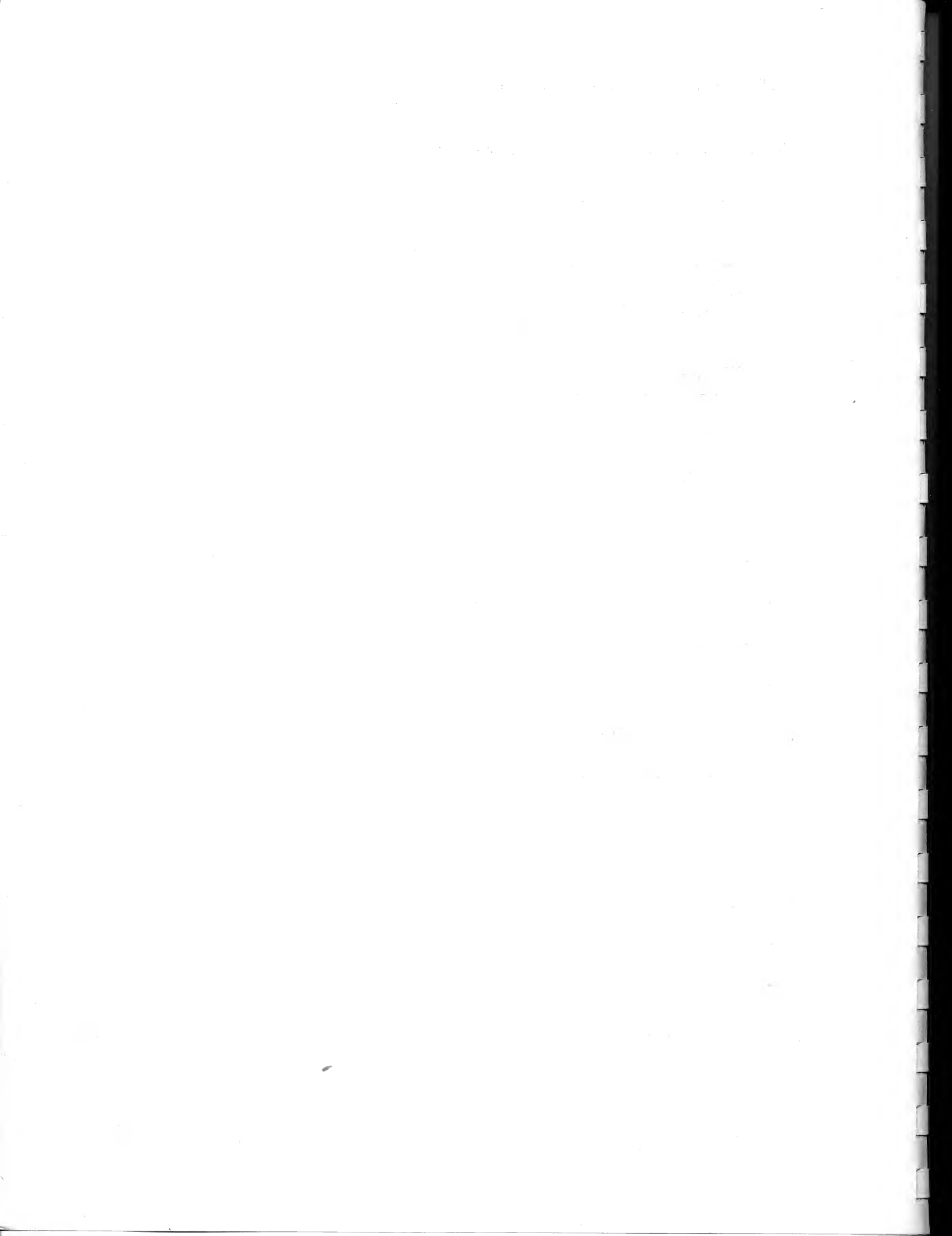
There are 132 symbols per line and 68 lines per page.

3.5.2 Input Data Format

There are two variations in the instruction of the print mode; print specified address is used to initiate the printing operation of the specified location; print current address is used to initiate the printing operation at the current location stored within the 1201.

The command format for the print operation is shown in the following.

XIT	$\frac{PSA}{PCA}$	$\frac{EPL}{EPH}$	$\frac{PRL}{PRN}$ PRS	NTR
-----	-------------------	-------------------	--------------------------	-----



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The data format for print specified address is shown below.

X ₁₀₀₀	X ₁₀₀	X ₁₀	X ₁	Y ₁₀₀₀	Y ₁₀₀	Y ₁₀	Y ₁	S ₁	S ₂
S ₃	S ₄	etc. to XIT							

The data format for print current address is shown below.

S ₁	S ₂	S ₃	S ₄	S ₅		S _n	etc. to XIT
----------------	----------------	----------------	----------------	----------------	------	----------------	-------------

3.5.3 Print Control Functions

The following control characters are directly usable in the PRINT mode and need not be preceded by XIT:

LRS	-	LINE RESET
PRL	-	PRINT LARGE
PRN	-	PRINT NORMAL
PRS	-	PRINT SMALL

Symbol orientation is not an available code in the PRINT mode, film frame orientation will be side-by-side.

3.6 Control Mode

This mode is used for all other operations capable of being performed by the 1201. These are auxiliary functions such as changing character orientation, advancing film, exposing the form projector, etc. To allow sufficient time for the execution of these operations, the tape unit must be stopped and then automatically restarted as required. This command requires an inter-record gap immediately after the NTR character. When all

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control codes are given in a single control word, a single inter-record gap suffices for all functions. Gaps may appear elsewhere in a tape; however, they are ignored unless the gap follows the control command word.

3.6.1 Data Format

The command word is shown below:

XIT	"CONTROL" OP CODE	CLR EOP	TOP NORTH ALIGNMENT TOP SOUTH ALIGNMENT TOP EAST ALIGNMENT TOP WEST ALIGNMENT	NTR
-----	----------------------	------------	--	-----

TYPICAL

The characters comprising this command word may be in any order within the control word.

3.7 Operational Functions

The operation characters and parameter characters previously discussed are functionally defined in the paragraphs to follow.

3.7.1 Plotting Functions

The 1201 is capable of plotting, at randomly addressed locations, any selected symbol in the symbol library. There are approximately 1,800,000 unique addresses available for plotting in a 1320 horizontal by 1360 vertical Cartesian coordinate system. Four decimal decades are utilized to specify the address in each axis.

3.7.1.1 Plot Normal Symbols (PLN)

This instruction causes the plot operation to occur within the selected symbol recorded in normal size.

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3.7.1.2 Plot Large Symbols (PLL)

This instruction causes the plot operation to occur with the selected symbol recorded in large size.

3.7.1.3 Plot Small Symbols (PLS)

This instruction causes the plot operation to occur with the selected symbol recorded in small size.

3.7.1.4 Top North Alignment (SYN)

This instruction selects normal symbol alignment for all symbols subsequently plotted or printed until negated by the receipt of another alignment code.

This and other symbol alignment instructions must be contained within the control mode word.

3.7.1.5 Top East Alignment (SYE)

This instruction selects Top East Alignment for all symbols subsequently plotted until negated by the receipt of another alignment operation code or the clear instruction. Top East Alignment is considered to be a rotation of 90° in the clockwise direction from the Top North Alignment.

This instruction will be executed upon receipt of the Top East Alignment operation code.

3.7.1.6 Top South Alignment (SYS)

This instruction selects Top South Alignment for all symbols subsequently plotted until negated by the receipt of another alignment operation code or the clear instruction. Top South Alignment is considered to be a rotation of 180° in the clockwise direction from the Top North Alignment.



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This instruction will be executed upon receipt of the Top South Alignment operation code.

3.7.1.7 Top West Alignment (SYW)

This instruction selects Top West Alignment for all symbols subsequently plotted until negated by the receipt of another alignment operation code or the clear instruction. Top West Alignment is considered to be a rotation of 270° in the clockwise direction from the Top North Alignment.

This instruction will be executed upon receipt of the Top West Alignment operation code.

3.7.2 Printing Functions

Symbol positioning on the 1201 may be done automatically, in a predetermined format, by instruction of a PRINT command and entering into the PRINT mode. When in the PRINT mode, symbols are positioned in the line from left to right. An inter-record gap must be programmed to avoid loss of data during the camera advance cycle. There are 132 character positions per line and 68 lines per frame.

Once the printer has been placed in the PRINT status via either a PRINT SPECIFIED ADDRESS or PRINT CURRENT ADDRESS instruction, each input tape character is utilized to convey a print character. When printing, it is necessary to sense only the print control instructions. Following are these control instructions.

XIT	-	EXIT
LRS	-	LINE RESET

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PRN	-	PRINT NORMAL SYMBOLS
PRL	-	PRINT LARGE SYMBOLS
PRS	-	PRINT SMALL SYMBOLS

Since these instructions must be sensed while printing, the symbols corresponding to the code of these instructions cannot be printed. In the PRINT mode, there are 56 printable symbols.

There are two ways of entering the PRINT mode. Either the PRINT SPECIFIED ADDRESS or PRINT CURRENT ADDRESS instructions will place the printer in PRINT status.

3.7.2.1 Print Specified Address

This instruction is used to cause the 1201 to enter PRINT status starting at the address specified in the word. In essence, the first data word is executed as a plot instruction. All successive data words must contain symbol information until an XIT instruction causes the machine to enter command status. Positioning becomes automatic as described in Paragraph 3.2.3.

3.7.2.2 Print Current Address

This instruction is used to place the printer in the PRINT mode with the first symbol appearing at the address contained in the deflection register at the time the instruction is received.

3.7.2.3 Print Normal Symbols (PRN)

This instruction is used to select normal symbol size for all symbols subsequently printed until another size modification instruction is received.

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The instruction will be executed when, in PRINT status, the PRINT NORMAL SYMBOLS operation code is sensed in any tape character. When this instruction is encountered by the printer, the position within the line is not advanced, introducing no discontinuity in symbol spacing.

3.7.2.4 Print Large Symbols (PRL)

This instruction is used to select large symbol size for all symbols subsequently printed until another size modification instruction is received.

This instruction will be executed when, in PRINT status, the PRINT LARGE SYMBOLS operation code is sensed in any tape character. When this instruction is encountered by the printer, the position within the line is not advanced, introducing no discontinuity in symbol spacing.

3.7.2.5 Print Small Symbols (PRS)

This instruction is used to select small symbol size for all symbols subsequently printed until another size modification instruction is received.

This instruction will be executed when, in PRINT status, the PRINT SMALL SYMBOLS operation code is sensed in any tape character. When this instruction is encountered by the printer, the position within the line is not advanced, introducing no discontinuity in symbol spacing.

3.7.2.6 Line Reset (LRS)

This instruction will, with the printer in the PRINT status, terminate the automatic positioning of symbols in the current line and position subsequent symbols on the line following, starting at the left edge of the format.

This operation will be executed when, in PRINT status, the LINE RESET operation code is sensed in any character of the input data.



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3.7.2.7 End of Page (EOP)

This instruction will cause film in the camera to advance one frame and reset deflection to 0.0 origin.

3.7.3 Control Functions

3.7.3.1 Clear (CLR)

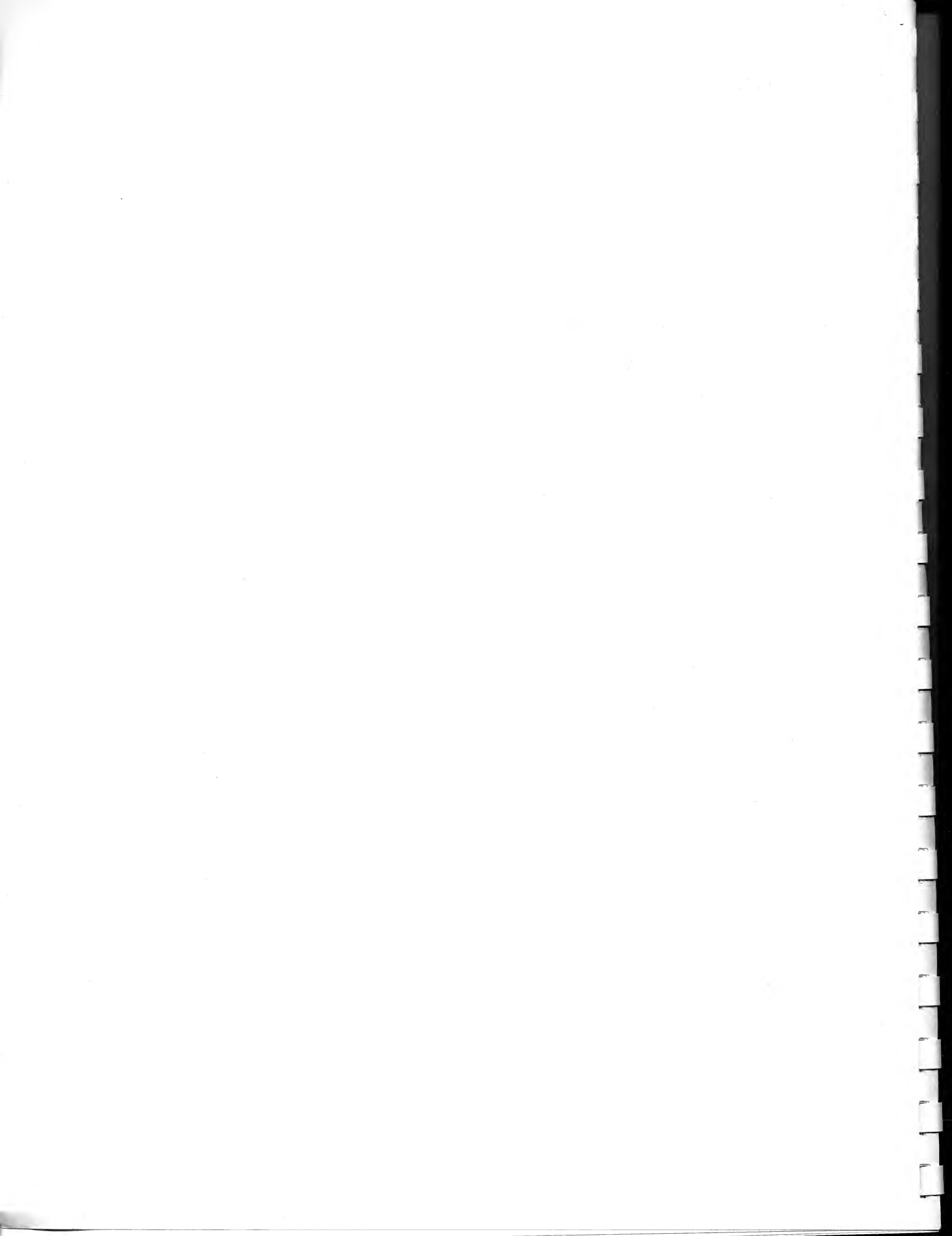
This instruction will cause the execution of several operations. CLEAR will set the deflection registers to the 0-0 address, select normal symbol size, provide the function of an ADVANCE FRAME instruction as stated in Paragraph 3.2.1.1 and select TOP NORTH ALIGNMENT.

3.8 Timing

Off-line operation of the 1201 requires certain timing considerations. Operating from high-speed magnetic tape transports, the 1201 can consume and successfully operate on incoming data without need of intermediary buffers for all functions handled electronically. However, operations such as CLEAR, ADVANCE FRAME, and CHARACTER ALIGNMENTS require a tape record gap immediately following the word in which such commands appear.

3.9 Operator Control

The 1201 is designed so that a minimum of operator attention is required. The printer controls the tape transport by means of control signals. The operator is required to change tapes on the transport, perform START, RESTART, and REWIND functions, as well as change film magazines and be able to recognize interlock conditions.



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3.10 Calibration and Test

Controls necessary for calibration and testing of the 1201 are located behind maintenance access doors. The test and calibration section of the printer contains the internal logic test generator controls, and the pertinent analog calibration controls necessary for routine alignment.

4.0 PERFORMANCE

4.1 Operating Speed

Each individual recording and control function in the printer requires a particular amount of time for its execution. Since all programs are not alike, in structure and operations, over-all operating speed varies with the composition of the program.

The following sections describe input data rates and execution times for individual recording and control functions of the printer.

4.1.1 Input Data Rates

Since input data can come from a variety of tape units, each must be considered separately. Data rates are determined by recorded bit density and tape speed as well as internal execution times of instructions which require record gaps. The 1201 is capable of accepting six-bit characters at rates up to 62.5 kc. Table 1 Paragraph 2.2.1 shows tape transports which are compatible with the 1201 and their character rates.

4.1.2 Execution Times

The time required to execute 1201 instructions is 16 microseconds per tape character with NOPs and gaps interspersed as required.

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4.2 Plotting Characteristics

Information plotted on the 1201 will meet the following specifications.

4.2.1 Coordinate System

The plotting format of the printer consists of a Cartesian coordinate system of 1320 horizontal by 1360 vertical addressable points. The points addressable on the plotting format are not the same as, and bear no scale relation to, the symbol writing matrix in the symbol generator which is used to generate symbols on the plotting format. (Three symbol sizes can be selected by program control and symbol size is adjustable as a calibration procedure.)

4.2.2 Positioning Accuracy

The over-all accuracy of the information on the output medium of the 1201 is determined by the sum of three unrelated error sources. These are deflection, cathode ray tube and optical errors. The composite error on the output medium of plotted information relative to the calculated position of that information is within $\pm 0.75\%$ of full scale, full scale being the distance between vertical (horizontal) positions 0 and 1360 at the horizontal (vertical) center of format. However, the position of a plotted point relative to an adjacent plotted point is accurate to $\pm .25\%$ in ten minutes and $\pm .5\%$ in 24 hours.

4.2.3 Resolutions

The diameter of the plotting dot will be less than $1/680$ of the full scale plotting axis dimension.



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4.3 Printing Characteristics

The specifications of the printing format of the 1201 are as follows.

4.3.1 Page Format

The printing format of the 1201 is composed of 132 print positions in a line and 68 lines to a page. Horizontal printing increments are ten plotting points per symbol position while vertical printing increments are twenty plotting points per line.

Upon entering the PRINT SPECIFIED ADDRESS instruction, the specified address can be at any plottable point on the format and will be integral multiple of ten plotting points only if so programmed.

4.3.2 Print Registration

All symbols will be positioned within a given line and all lines positioned on the page to the plotting performance accuracies specified in Paragraph 4.2. Additionally, when any line or column segment of up to 16 symbol spaces is considered, the misalignment of randomly selected symbols with respect to a normal straight line shall not exceed $\pm 5\%$ of a symbol height.

When checking this adjacent symbol registration, the symbols shall be printed or plotted sequentially and all symbol spaces shall be occupied. The distance between the top of the highest symbol and the bottom of the lowest symbol in a horizontal line segment shall not exceed the normal symbol height by more than 10%. Similarly, the distance between the right side of the rightmost symbol and the left side of the leftmost symbol in a vertical column segment shall not exceed the normal symbol height by more than 10%.

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All three sizes shall be printed in whatever sequence in a given line when performing this test.

The lines of print shall not have a jagged or objectionable appearance when the foregoing specifications are met.

4.3.3 Symbol Specifications

4.3.3.1 Symbol Size

Three symbol sizes are selectable by program control. NORMAL symbol size is typically adjusted to correspond to a height of 0.093 inch when the recorded image is blown back to produce 10 symbols per inch and 5 lines per inch. SMALL and LARGE symbol heights are approximately $\frac{2}{3}$ and $\frac{4}{3}$ NORMAL symbol height respectively. Symbol size is uniform over the entire frame to within $\pm 5\%$.

The size and aspect ratio of symbols is adjustable as a calibration procedure to allow a latitude of symbol sizes.

4.3.3.2 Symbol Quality

The symbols obtained as output from the 1201 are clearly legible. They are designed for a minimum of ambiguity between similarly shaped symbols. Symbol skew, tilt and other distortions are negligible.

4.4 Film Advance Speeds

The camera requires not more than 34 milliseconds to advance film each frame.

4.5 Checking

The 1201 continually monitors functions which, by malfunction or normal

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causes, will render the printer inoperable. The following sections describe these checking features in detail.

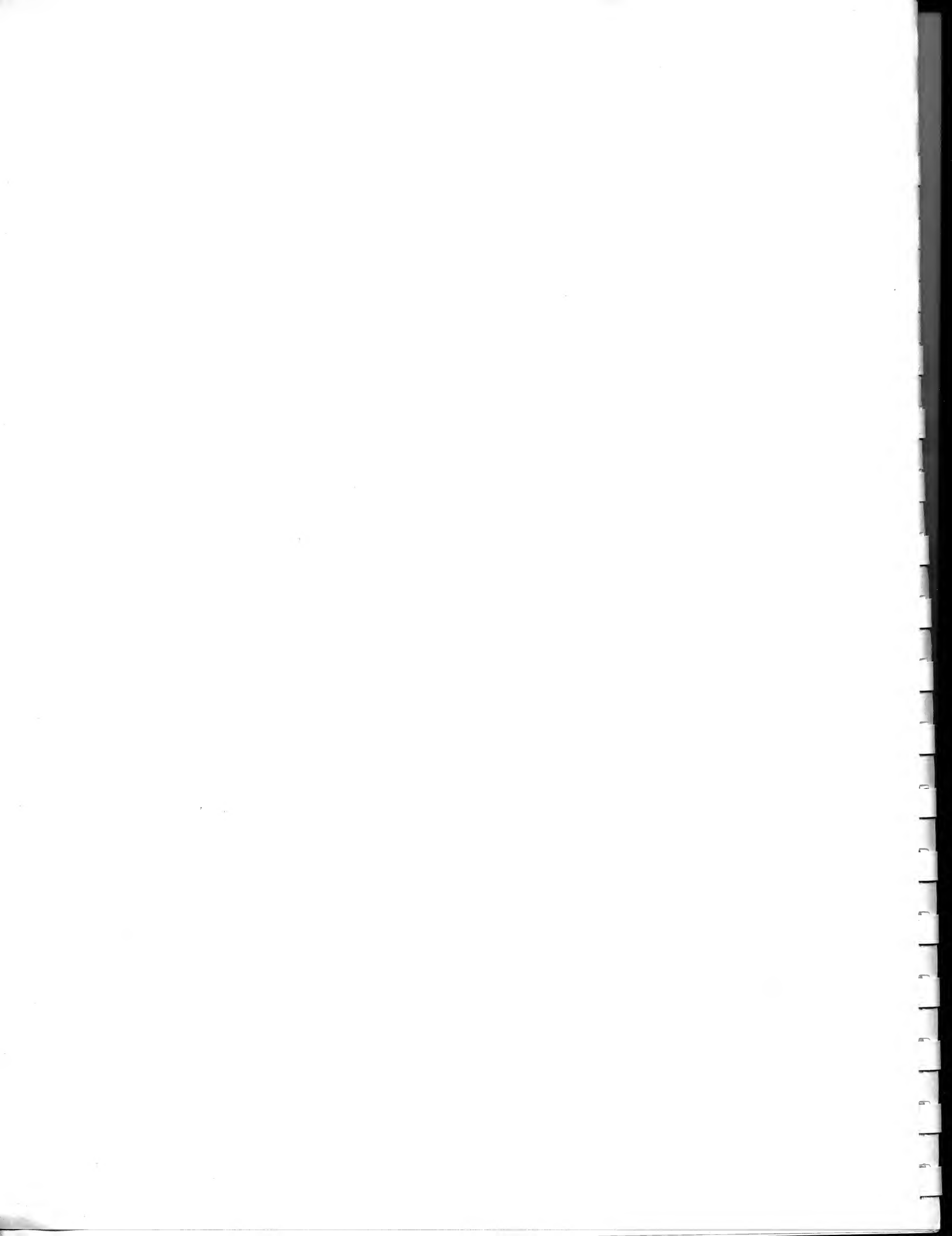
4.5.1 Data Check

Data received by the 1201 is given two parity checks, both lateral and longitudinal. Additionally, the printer checks to see that not more than 132 printable symbols are programmed between LRS commands and that not more than 68 lines are included on a page. If either of these conditions are not met, the printer stops the tape transport and an alarm light is activated.

Each 6-bit character read into the control logic is checked for lateral parity.

Similarly, each data channel is checked for longitudinal parity in a record. If a lateral parity error occurs, the PARITY ERROR character is forced into the symbol selection register at this time and is printed. This occurrence also lights a parity error light and stops the printer at the next record gap. The operator can decide whether to attempt to read that frame of data again or to go on to new data by depressing either the RESTART or the START pushbutton. If the RESTART pushbutton is depressed, the tape transport is caused to go back to the beginning of the frame and a light is flashed in the optics area of the printer voiding the frame of film containing the error.

If the START pushbutton is depressed after an error, an error marker lamp is illuminated to record a special mark on the margin of the frame



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to signify that an error has been recorded in that frame. The foregoing procedures are also observed in the case of longitudinal parity error, except that the PARITY ERROR symbol is not printed on the film.

4.5.2 Interlocks

Functions whose occurrence would render the 1201 inoperative interlock the operation of the printer. A list of these interlock checks are shown below.

1. Microfilm camera door open.
2. Microfilm camera takeup magazine full or not in place.
3. Microfilm camera film supply exhausted or supply magazine not in place.
4. Internal test generator on.
5. Line too long. This condition is sensed when printing reaches the last position of the line and a line reset has not been received.
6. Page too long. This condition is sensed when the last character position of the last printable line is reached and an end-of-page command is not received.
7. Over temperature on air cooled heat sinks.

